Prototype S- and X-Band Feed System Hardware

M. S. Katow and H. R. Hoggan
DSIF Engineering Section

The hardware for supporting the prototype S- and X-band feed system on the 64-m-diameter antenna is described. The S-band ellipsoid reflector is supported on flextures which provide for thermal expansion. The X-band dichroic/S-band flat reflector assembly consists of a welded assembly of aluminum plates with provisions to mount the X-band transparent sheet.

I. Introduction

The S- and X-band feed system on the 64-m-diameter antenna will provide simultaneous S-band diplexed operation and X-band receiving capabilities along the same RF boresight direction. The functional descriptions of the physical hardware assemblies were noted in Ref. 1, and the radio frequency techniques were described in Ref. 2.

This article describes the hardware designs of the reflectors and their supporting system. Photographs of the top portion of the supporting truss for the ellipsoid undergoing fabrication are included. The descriptive photos of the dichroic plate assembly will follow in later articles along with detailed descriptions of the retraction mechanisms.

Additional analyses of radio frequency techniques are found in another article[1] in this technical report.

[1]See "S- and X-Band RF Feed System," by P.D. Potter in this issue.

II. Hardware Design Description

The ellipsoid reflector over the S-band feed horn of the tricone RF feed system is supported by an aluminum truss assembly attached to the S-band cone. Mechanism will be provided for retraction of the ellipsoid reflector from the S-band RF boresight line and allow normal use of the feed horn with the Tricone Cassegrain System.

The ellipsoid will be formed from 3.2-mm (0.125-in.)-thick 1100-H14 aluminum sheet. This material was selected because of its availability from stock (large width requirement) and its high electrical conductivity, which should minimize the RF surface current losses and the resulting heating effects on the ellipsoid's shape. A special drop hammering process will form the dish-like shape. With the use of an egg-crate type of male form, to be described in detail in a later article, the ellipsoid shape may be qualified continuously during the shaping process.

To provide for thermal expansion of the ellipsoid reflector, it will be mounted from the truss structure by a flexture-type of tangential shear supporting means. The

flextures consist of 1.7-mm (0.06-in.)-thick aluminum sheets fastened to the nonagon-shaped mounting face of the supporting truss structure. By attaching these sheets to the ellipsoid sheet with clips at short intervals, the ellipsoid is effectively supported by a round-like tube of approximately 1.7-m (64-in.) diameter. The nonagonal shape of the tube provides for both the thermal expansion of the ellipsoid by the bending action of the flextures and its rigid support from the nonagonal truss face by the flectures' tangential shear stiffness.

Figure 1 shows the nonagonal-faced truss being fabricated on a fixture plate. A close-up is shown in Fig. 2 with a round fixture spacer in place.

The combination S-band flat reflector and X-band dichronic plate assembly will be 1.58 m (62 in.) in diameter and supported from the X-band cone. The assembly will also be retractable by a mechanism under remote control. This movement provides for use of the other experimental feed horns on the X-band cone in the normal Cassegrainian system.

The 1.58-m (62-in.)-diameter flat will be a welded fabricated assembly of aluminum plates forming a boxed structure with an opening covered by the dichroic plate.

III. Future Work

The retraction mechanisms for both reflectors will be described in a future article. Means to control the heat distortions of the dichroic plate when it is reflecting the 450-kW S-band RF will also be discussed later.

References

1. Katow, M., "S- and X-Band RF Feed System," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. VI, pp. 139–141. Jet Propulsion Laboratory, Pasadena, Calif., Dec. 15, 1971.
2. Potter, P. D., "S- and X-Band RF Feed System," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. VIII, pp. 53–60. Jet Propulsion Laboratory, Pasadena, Calif., Apr. 15, 1972.

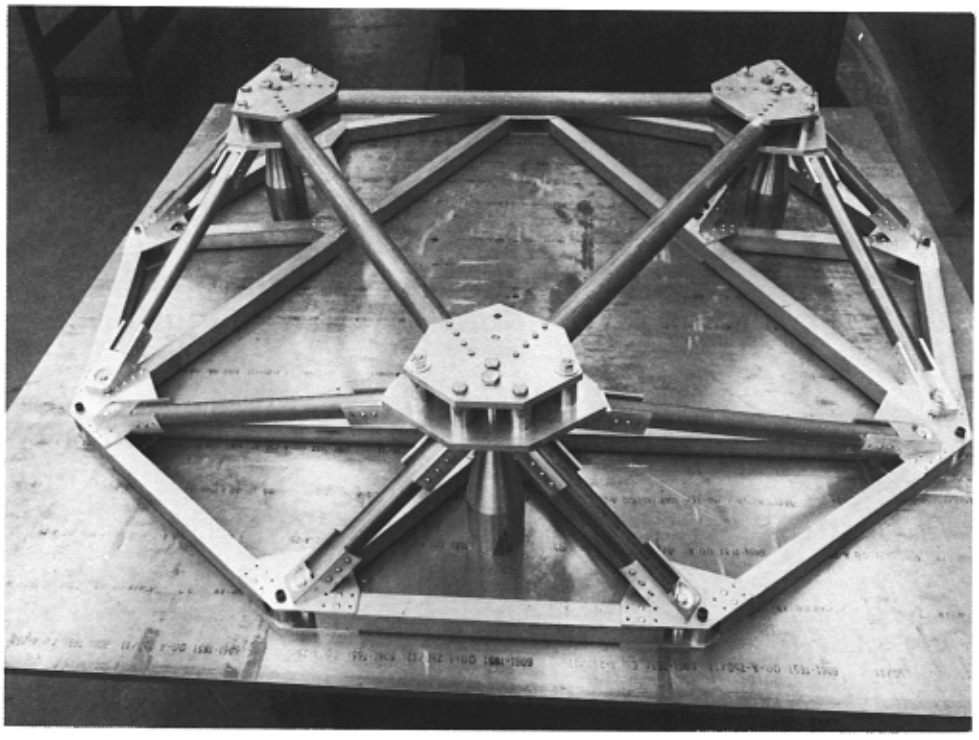

Fig. 1. Ellipsoid support truss

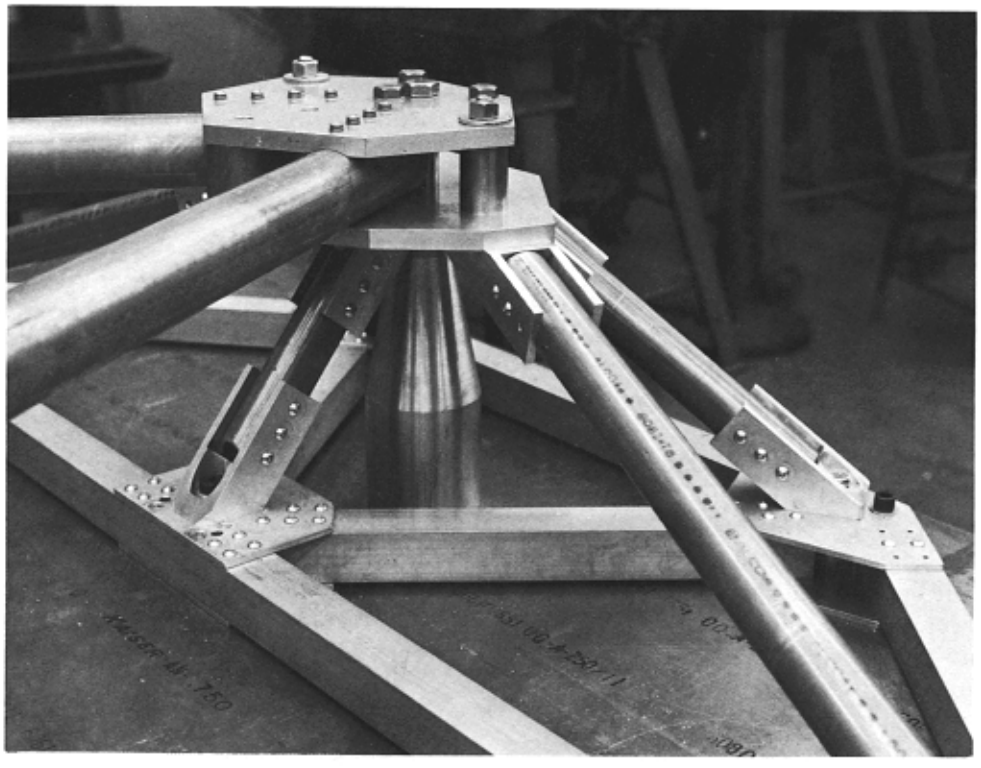

Fig. 2. Ellipsoid support truss close-up